mands for appropriate events and/or performs other appropriate actions, which correspond to the GUI object **310** (Step **344**).

[0098] In case (iii), the GUI object **310** is not actuated but the apparatus **1** is tracking the pressure value and attempt to recognize an actuation event, i.e. some gesture that allows the user to specify that the GUI object **310** should be actuated. Such gesture event could be for example, impulse-like increase of pressure, i.e. the user quickly presses and releases the GUI object. A user interface software may be utilizes to recognize a spike in the pressure applied to the GUI object **310** and treat it as an actuation event.

[0099] In the present embodiment, the hotspot area associated with the GUI object may be arbitrary designed, thereby enabling to provide the user **2** a tactile feedback when the finger crosses this hotspot area. For example, as shown in FIG. **7**(*a*), the hotspot area **501** may be provided inside of the GUI button **500** for presenting a tactile feedback when the user slides the finger inside of the GUI button **500**.

[0100] Another example of such hotspot is a boundary **502** of the GUI object **500** as shown in FIG. **7**(*b*). Alternatively, the hotspot may have any arbitrary shape such as an area **503** as shown in FIG. **7**(*c*). The GUI object **500** may have several hotspots. For example, in FIG. **7**(*d*), there are two hotspots **502** and **504**: first is the boundary **502** the GUI object **500** and second is the center **504** of the GUI object **500**. Consequently, the tactile feedback will be provided when the user **2** slides the finger into the GUI object and then when the user slides the finger into the center. Any other configuration may be employed as long as such hotspot can indicate directly or indirectly a position or area of the GUI object to the user **2** via the tactile feedback.

[0101] The tactile feedback may be provided only when the user slides the finger into the hotspot and is not provided when the user slides outside of the hotspot. This variation for presenting the tactile feedback can be useful when the user **2** slides a finger quickly over a GUI object and the resulted feedback is too strong or confusing.

[0102] The interaction techniques can be further extended to provide a continuous tactile feedback to the user **2** while the finger is inside of the hotspot. For example, as long as the finger is inside of the hotspot, the tactile feedback of continuous wave shape may be provided.

[0103] The tactile feedback may be generated in various forms such as the followings:

(1) A continues and constant tactile wave shape; e.g. a vibration of the constant frequency is provided while the user's finger is inside of the GUI object. The parameters of the tactile feedback are constant and do not depend on the position of the finger inside of the GUI object or the pressure applied by the user on the GUI object.

(2) A dynamic tactile wave shape where tactile feedback parameters (e.g. frequency, amplitude, intensity, etc) are a function of the pressure applied by the user on the GUI object; The dependency can be

[0104] (a) a step function, e.g. when the user **2** presses a button-type GUI object, such that tactile feedback changes in discreet steps; or

[0105] (b) the continuous dependency between feedback and pressure applied, e.g. the stronger the user presses the button the higher the vibration frequency can be or the amplitude of the vibrations. In the simplest case, the intensity of tactile feedback increases as the user presses stronger. Any other function may be used to map pressure into tactile feedback intensity.

[0106] The tactile feedback may also be generated in accordance with any other parameter or multiple parameters that define the tactile waveshape.

[0107] Another variation of the tactile feedback may be provided when the user **2** changes the pressure inside of the GUI object. In this variation, when the user **2** places the finger inside of the GUI object and presses on it, the tactile feedback is provided for each incremental change in the pressure applied. The incremental change may be either increasing or decreasing.

[0108] FIG. **8** provides an example of interaction flow for such variation of the tactile feedback. In this example, the user **2** slides the finger into a GUI object with the pressure p**0** (Step **800**). This initial pressure is detected and stored as variable ps (Steps **802**, **803**).

[0109] The apparatus **1** tracks the finger's position/pressure and checks if the finger is inside of the GUI object (Steps **804**, **806**). If the apparatus **1** determines that the finger is not inside of the GUI object, the flow proceed to end. If the finger is inside of the GUI object, the apparatus **1** further determines if the actuation event is recognized (Step **808**).

[0110] If the actuation event is not recognized, the apparatus further determines if the pressure applied to the GUI object changed more than a preset threshold value d (Step **810**). If the pressure changed more than the threshold value d, the current pressure is registered (Steps **812**, **813**) and the appropriate tactile feedback is provided depending on the position, the applied pressure, the logical state of the GUI object (Step **814**). If the actuation event is recognized, the apparatus **1** provides the tactile feedback for the actuation event (Step **820**), and then activates GUI object, sends a command for appropriate events and/or performs other appropriate actions (Step **822**).

[0111] Alternatively, the tactile feedback may be provided when the user moves the finger within the GUI object, i.e. the change in x-y coordinates creates tactile feedback impulse. For example, in simplest case, every time the user **2** moves the finger within the GUI object and changes the position by a certain distance d, a tactile click (or other tactile feedback wave shape) may be provided. Further, the tactile feedback may also be correlated with amount of pressure applied on the screen. According to this tactile feedback generation scheme, various textures of the GUI object may be simulated by changing distance d or direction thereof. The threshold value d for evaluating the size of the change may be absolute or relative value.

[0112] FIG. **9** provides another example of interaction flow. In this example, the user **2** slides the finger into a GUI object (Step **900**). This initial position is detected and stored as xs and ys (Steps **902**, **903**).

[0113] The apparatus **1** tracks the finger's position/pressure and checks if the finger is inside of the GUI object (Steps **904**, **906**). If the apparatus **1** determines that the finger is not inside of the GUI object, the flow proceed to end. If the finger is inside, the apparatus **1** further determine if the actuation event is recognized (Step **908**).

[0114] If the actuation event is not recognized, the apparatus **1** further determines if the position of the finger changed more than a preset threshold value d (Step **910**). If there is the position change more than the threshold value, the current position is registered (Steps **912**, **913**) and the